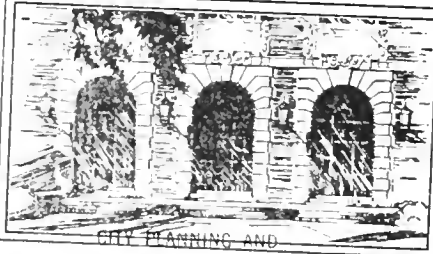


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**THE APPLICATION OF ECOLOGICAL CONCEPTS TO PLANNING:
An Initial Annotated Bibliography**

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THE APPLICATION OF ECOLOGICAL CONCEPTS TO PLANNING:

AN INITIAL ANNOTATED BIBLIOGRAPHY

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Thanks are due to Meir Gross, who assisted in the preparation of this bibliography.

Planners continue to look to the natural sciences--including the rather young science of ecology--for concepts and generalizations which might be transferred to the realm of planning. This bibliography grew from an interest in identifying authoritative discussions of such concepts as diversity, stability, succession and carrying capacity, as well as planning studies which attempt to translate these concepts to the field of planning.

Such an examination inevitably included discussions of how planners can and must "design with nature" that is, plan with an understanding of, and respect for, natural processes. But this was not the primary thrust.

This bibliography does not pretend to be exhaustive, either in the range of topics it covers, or in the coverage of any given topic. I felt, after some encouragement from my colleagues, that even in its present form it might be of use to others with similar interests. I would welcome suggestions of other sources which readers have found valuable.

The starred items (*) were particularly useful to me, and are sources I would recommend to others initially tackling this subject. But you are undoubtedly starting at a different point, with a different background, so your own list will likely be different.

Bayley, Suzanne and Howard T. Odum (1973). Energy Evaluation of Water Management Alternatives in the Upper St. Johns River Basin of Florida. Report of the EPA Water Program, Region IV Office, Atlanta, Georgia, made in collaboration with Department of Environmental Engineering Sciences, University of Florida Gainesville, 114 pp.

An application of Odum's energy evaluation approach.

Bishop, A. B., H. H. Fullerton, A. B. Crawford, M. C. Chambers and M. McKee (1974). Carrying Capacity in Regional Environmental Management, U.S. Environmental Protection Agency, Washington, D. C., EPA-600/5-74-021, 170 pp.

Four dimensions of a human oriented carrying capacity--resource/production, environment/residuals, infrastructure/congestion & production/societal relations--are described within normative and operational definitions of carrying capacity. A carrying capacity-based planning process is described where the forces for change in the region are analyzed in terms of impacts on identified carrying capacity indices and compared with desired levels.

Bishop, A. Bruce, Richard Toth, A. B. Crawford, and H. H. Fullerton (1973). "The Concept of Carrying Capacity," in Final Conference Report for the National Conference on Managing the Environment, prepared for the Office of Research and Development, U. S. Environment Protection Agency, also in Managing the Environment, U. S. Environmental Protection Agency, EPA-600/5-73-010.

Cites two planning examples in northern Utah, and identifies key carrying capacity issues for understanding and analyzing the ability of the environment to absorb or support activities associated with urban and regional growth.

*Boulding, Kenneth E. (1966). "Economics and Ecology," pp. 225-234 in Future Environments of North America, F. Fraser Darling and John P. Milton, Natural History Press, Garden City, New York.

Outlines at least five similarities between ecology and economics. A stimulating essay, suggesting some Dead End signs for blind (ecological) conservatism which simply takes the existing distribution of natural populations as given, sacred, and sacrosanct; as well as some Thin Ice signs for the economist who in pursuit of purely human values may be running mankind into grave dangers.

- *Boulding, Kenneth E. (1966). "The Economics of the Coming Space-ship Earth," in Environmental Quality in a Growing Economy, 1966, Johns Hopkins University Press, reprinted in Herman E. Daly, ed., Toward A Steady-state Economy, W. H. Freeman, San Francisco, 1973.

An important essay, on the necessity for society in general and economists in particular to make the change to the perception of a closed rather than an open system; the space-ship economy rather than the cowboy economy.

- Boulding, Kenneth E. (1973). "The Economics of Ecology," pp. 27-30, in Managing the Environment, U. S. Environmental Protection Agency, EPA-600/5-73-010.

A much briefer essay on economics and ecology. Touches on human activities as a subset of the ecosystem, and on the implications of imperfect equilibrium.

- Caldwell, Lynton K. (1969). "Health and Homeostasis as Social Concepts: An Exploratory Essay," in Diversity and Stability in Ecological Systems, Brookhaven Symposium in Biology, No. 22.

A survey of homeostasis and equilibrium as elements of social thought (the Physiocrats, Malthus, Spencer) through the present, and a discussion of diversity and stability as social values.

- Cole, LaMont C. (1964). "The Impending Emergence of Ecological Thought," Bioscience, 14 (7): 30-32, July, reprinted in Shepard and McKinley, The Subversive Science.

Prepared for the Ecological Study Committee of the Ecological Society of America. Criticism of broad-spectrum antibiotics or pesticides, in the light of the ecological generalization that all niches tend to be filled, and that selection will operate in the direction of filling vacant ecological niches; relates number of niches and stability to environmental stress.

- Commoner, Barry (1971). The Closing Circle: Nature, Man and Technology, Bantam Books, New York.

Presumably you've read this.

- *Conservation Foundation (1974). "Carrying Capacity Analysis is Useful--But Limited," Conservation Foundation Letter, June 1974.

An excellent introduction to carrying capacity as a planning tool: its potential and its limitations. Discusses or refers to a number of applications.

- *Cooper, William E. and Raymond D. Vlasen (1973). "Ecological Concepts and Applications to Planning," in Donald M. McAllister, ed., Environment: A New Focus for Land-Use Planning, National Science Foundation, Washington, D. C. 20550.

Addressed technical relationships and realities concerning man and ecosystems (transport and storage, control processes, time scales, spatial dimensions, stability, succession, natural constraints, and processing capabilities), operational concepts for use by planning practitioners, and institutional arrangements.

- *Dansereau, Pierre (1966). "Ecological Impact and Human Ecology," in Future Environments of North America, F. Fraser Darling and John P. Milton, eds., Garden City, New York: Natural History Press.

A historical survey of ecology and ecological thought, and application to an ecology of man. Includes as an appendix 27 laws of ecology, and a table of methodological criteria and units involved at each integrative level of the study of environmental processes and relationships. Extensive bibliography.

- Darling, F. Fraser (1951). "The Ecological Approach to the Social Sciences," American Scientist, 39 (2): 244-256 (April), reprinted in Shepard and McKinley, The Subversive Science.

A human ecological study of the West Highlands.

- Darling, F. Fraser (1970). "A Wider Environment of Ecology and Conservation," pp. 3-19 in Roger Revelle and Hans H. Landsberg, eds., America's Changing Environment, Houghton Mifflin Co., Boston. (also Daedalus, Fall 1967)

A brief survey of the development of ecological thinking and knowledge, and how these might be brought to bear on public policy.

- Dasmann, Raymond F., John P. Milton and Peter H. Freeman (1973). Ecological Principles for Economic Development, John Wiley and Sons, London.

Written from the point of view of the ecologist for the use of those concerned with development whether at a purely national level or in connection with any of the aid programs of international agencies. Chapter 2 discusses general ecological considerations, while the succeeding chapters deal with development of tropical humid lands, development of pastoral lands in semi-arid and sub-humid regions, development of tourism, agricultural development projects, and river basin development projects.

Dyck, Robert G., Robert C. Lee and Robert F. Wells (1974). "Implications of Entropy for Resource Management," Paper delivered at 1974 AIP conference (no. 206), 18 pp.

Proposes entropy minimization as an alternative to the "invisible hand" as a guiding theory for socio-economic activity. Extends Limits to Growth-type model to 400-600 year time horizon. Lists implications of the entropy approach in areas of natural resource depletion, pollution, population, capital investment, quality-of-life.

Farvar, M. Taghi, and John P. Milton, eds., (1972). The Careless Technology: Ecology and International Development, Natural History Press, Garden City, New York.

An extensive collection of case studies of unforeseen ecological consequences of international development activities. Several essays (White, Caldwell, and others) deal with the goals of development, and the relationship of ecological knowledge or ignorance to planning.

Fisher, A. C. and J. V. Krutilla (1972). "Determination of Optimal Capacity of Resource-Based Recreational Facilities," Natural Resources Journal, 12:415-444 (July), also appears in John V. Krutilla, ed., Natural Environments: Studies in Theoretical and Applied Analysis, published for Resources for the Future, Inc., by the Johns Hopkins University Press, Baltimore.

*Georgescu-Roegen, Nicholas (1971). "The Entropy Law and the Economic Problem," University of Alabama Distinguished Lecture Series No. 1, 1971; reprinted in Herman E. Daly, ed., Toward a Steady-State Economy, W. H. Freeman, San Francisco, 1973.

A good introduction to the concept of entropy and its application to economic theory. "In entropy terms, the cost of any biological or economic enterprise is always greater than the product."

*Godschalk, David R. and Francis H. Parker (1974). "Carrying Capacity: A Basis for Planning," paper delivered at the 1974 AIP Conference, No. 209, 17 pp.

Excellent discussion of carrying capacity, its appeal, and the difficulties of definition, measurement, and methodology which arise in practice. Given the lack of a comprehensive "Mother Nature" model, the authors suggest two strategies: 1) learning from experience with controls on selected factors, and 2) attempting to define operational thresholds for environmental, institutional, and perceptual carrying capacity, beyond which qualitative changes occur.

- *Hardin, Garrett (1963). "The Cybernetics of Competition: A Biologist's View of Society," Perspectives in Biology and Medicine, 7 (1): 58-84, (Autumn); reprinted in Shepard and McKinley, The Subversive Science.

A discussion of feedback and stability, systems thinking, and variability. The final section, "Is planning possible?" examines the preconditions for successful planning, and the directions it must take to maximize both social stability and human freedom.

- Hardin, Garrett (1968). "The Tragedy of the Commons," Science 162:1243-1248; reprinted in Herman E. Daly, ed., Toward a Steady-State Economy, W. H. Freeman, San Francisco, 1973.

Addresses the carrying capacity of the earth, through the analogy of the village commons, concludes that we cannot continue to breed indefinitely (and that natural feedback mechanisms are intolerable); concludes that what is needed "is mutual coercion mutually agreed upon".

- Hardin, Garrett (1969). "Not Peace, But Ecology," in Diversity and Stability in Ecological Systems, Brookhaven Symposium in Biology No. 22.

Emphasizes the different approaches of the physicist (whose world is largely governed by inverse square laws) and the biologist (whose world is governed by exponential growth processes and feedback mechanisms). Reviews a trend toward increasing awareness and internalizing of previously "external" costs.

- Holling, Crawford S. (1969). "Stability in Ecological and Social Systems," in Diversity and Stability in Ecological Systems, Brookhaven Symposium in Biology No. 22, pp. 128-141.

An application of predator-prey models to recreational land acquisition.

- *Holling, C. S. and M. A. Goldberg (1971). "Ecology and Planning," Journal of the American Institute of Planners, 37:4 (July); excerpted as "The Nature and Behavior of Ecological Systems" in Managing the Environment, U. S. Environmental Protection Agency, EPA-600/5-3-010.

Discussion of essential properties of ecological systems, and the analogy with urban systems. Excellent discussion of stability and thresholds; poses a challenge to the common presumption in planning that an incremental change will quickly generate a signal of whether the intervention is correct or not.

- *Holling, C. S. and G. Orlans (1971). "Toward an Urban Ecology," Bulletin of the Ecological Society of America, 52 (2): 2-6.

Report from an Ad Hoc Committee on Urban Ecology of the Ecological Society of America. Stresses the limitations of present ecological knowledge. Identifies similarities between urban and ecological systems (historical, spatial systems, and structural properties) and differences. Explores the role of ecology and identifies four areas where ecologists might make a particular contribution, including "developing new philosophies of planning that emphasize boundaries of stability rather than equilibrium conditions".

- Humphrey, Clifford (1971). "Constructing New Life Styles from an Ecological Perspective," Ecology Action Educational Institute.

Focuses on the idea that while we may overshoot (temporarily) the capacity of our life support system, this will lower the long-term support capacity when we do bring our society to a steady-state consistent with long-term survival.

- Israel, Barry (1974). "Some Emerging Techniques in Growth Control," part II, American Institute of Planners Newsletter, July 1974, pp. 7-9.

Discussion of 'holding capacity' as a planning tool for limiting or regulating growth. Refers to Pinellas Co., Florida and Medford, New Jersey.

- Kusler, Jon A. (1972). Carrying Capacity Controls for Recreation Water Uses, An Inland Lake Renewal and Shoreline Management Project Report, Funded by the Upper Great Lakes Regional Commission.

Emphasizes control mechanisms rather than means of determining carrying capacity.

- Leopold, Aldo (1949). "The Land Ethic," in A Sand County Almanac, Oxford University Press, Inc.

If you haven't read it, read it.

- Lime, David W. and George H. Stankey (1971). "Carrying Capacity: Maintaining Outdoor Recreation Quality," pp. 174-184, in Recreation Symposium Proceedings, Northeast Forest Experiment Station, Upper Darby, Pennsylvania.

Discusses the concept of recreational carrying capacity, what is known about capacity in terms of how resources and visitors' perceptions are affected by recreational use, and management techniques for recreation areas.

Margelef, Ramon (1963). "On Certain Unifying Principles in Ecology," American Naturalist, 97:357-374, as reprinted in Kormondy, Edward J., Readings in Ecology, Prentice-Hall, Englewood Cliffs, New Jersey, 1965.

Some generalizations on structure, diversity, succession, and energy in ecosystems.

McHarg, Ian L. (1967). "An Ecological Method for Landscape Architecture," Landscape Architecture, pp. 105-107, January 1967, reprinted in Shepard and McKenley, The Subversive Science.

An early synthesis of ecological criteria as values for planning.

McHarg, Ian L. (1969). Design with Nature, Doubleday Natural History Press, Garden City, New York.

Presumably you've read this.

McKenzie, Roderick D. (1925). "The Ecological Approach to the Study of the Human Community," chapter III in The City, Robert E. Park, Ernest W. Burgess and Roderick D. McKenzie, University of Chicago Press, reprinted in 1967.

Murdoch, William and Joseph Connell (1970). "All About Ecology," The Center Magazine, 3 (1): 56-63.

A good brief introduction to ecological principles. Argues that while ecologists cannot provide a set of rules of the kind needed to manage the environment, their basic ecological attitude is itself the solution to the problem.

Nisbet, Ian C. T. (1973). "Ecosystems Under Stress," Technology Review, December 1973, pp. 6-7.

Emphasizes the limited predictive ability of ecological concepts of complexity, diversity and stability.

*Odum, E. P. (1969). "The Strategy of Ecosystem Development," Science, 164: 262-270.

Integrates a number of ecological concepts in the context of succession: pioneer and climax ecosystems.

*Odum, Eugene P. (1971). Fundamentals of Ecology, 3rd edition, W. B. Saunders Co., Philadelphia.

Especially chapter 21, "Toward an Applied Human Ecology."

Odum, Eugene (1971). "Ecosystem Theory in Relation to Man," in Ecosystem Structure and Function, Proceedings of the 31st Annual Biology Colloquium 1970, ed., John A. Wiens, Oregon State University Press.

Odum, Howard T. (1971). Energy, Power, and Society, John Wiley and Sons, 1971.

Introduction to Odum's energy circuit language, with a number of applications and speculations.

Odum, Howard T. and Larry L. Peterson, n.d., "Relationship of Energy and Complexity in Planning," (unlabeled reprint, 6 pp.).

Discussion of energy, complexity, succession and climax in modeling human settlements. Brief discussion of application to Ft. Myers, Florida.

Peterson, Eugene K. (1973). "One Approach to Averting Environmental Crises," excerpted as chapter 3, "Analysis of Carrying Capacity," in Working Papers in Alternative Futures and Environmental Quality, U. S. Environmental Protection Agency, May 1973, pp. 92-133.

Planning for the Pacific Northwest on the basis of carrying capacity. Taking a fixed per capita income level, population, industry, pollution control, and recreation use are considered in relation to the resource base of the Pacific Northwest.

Peterson, Larry (1974). "Presentation to the Sub-Committee on Energy and Land Use Oregon Legislature 1974," Office of Energy Research and Planning, Office of the Governor, State of Oregon, edited transcript, August 1974.

Peterson is the former director of the Florida Carrying Capacity Committee, and uses the energy systems approach of H. T. Odum. He presents carrying capacity as a three-way tug of war between population, available energies, and space. "It is not a number, . . . it is an idea--a concept of how to keep track of where you are and what the consequences of your decisions will be in advance." Considers "absolute" vs. relative carrying capacity; discusses dollar and energy flows.

Randers, Jørgen and Donella Meadows (1972). "The Carrying Capacity of Our Global Environment: A look at the Ethical Alternatives," in Herman E. Daly, ed., Toward a Steady-State Economy, W. H. Freeman, San Francisco, 1973.

A look at the Limits to Growth model, and the requirements for long-term equilibrium. Examines potential global limiting factors: agricultural land, heat release, and pollution absorption.

Ripley, S. Dillon and Helmut K. Buechner (1970). "Ecosystem Science as a Point of Synthesis," pp. 20-27 in Roger Revelle and Hans H. Landsberg, eds., America's Changing Environment, Houghton Mifflin Co., Boston; (also Daedalus, Fall, 1967).

Suggests a model for organizing knowledge on an ecological theme in terms of the concepts of "levels of biological integration" and "points of view". Explores the necessary organizational structure for ecological research, education, and communication of information to society.

Sears, Paul B. (1959). "The Steady State: Physical Law and Moral Choice," The Key Reporter, 24 (2): 2-3, 8 (January), reprinted in Shepard and McKinley, The Subversive Science.

A plea by an eminent ecologist for a limit to population, and for achievement of a steady state "an efficient dynamic equilibrium between man and his environment".

Shepard, Paul and Daniel McKinley, eds., (1969). The Subversive Science: Essays Toward an Ecology of Man, Houghton Mifflin Co., Boston.

A collection of essays, arranged under the headings: Men as Populations, the Environmental Encounter, Men and Other Organisms, Men in Ecosystems, and Ethos, Ecos, and Ethics.

Stankey, George H and David W. Lime (1973). Recreational Carrying Capacity: An Annotated Bibliography, USDA Forest Service General Technical Report INT-3, Intermountain Forest and Range Experiment Station, Ogden, Utah 84401, 45 pp.

An annotated bibliography of over 200 references dealing with the concept of carrying capacity, biological investigations of carrying capacity, and managing for carrying capacity. Deals almost exclusively with recreational carrying capacity.

Von Wodtke, Mark (1970). "The Carrying Capacity of the Los Angeles Basin," Cry California, 5:22-26, (fall).

Given present life-styles, the air resources of the Los Angeles basin calculated to be insufficient for a population of more than about 14 million--assuming that percapita emissions are reduced as much as current plans indicate. The California Department of Water Resources plans for 2020 are based on a population projection of 23 million.

Wallace, McHarg, Roberts, and Todd (1972). An Ecological Planning Study for Wilmington and Dover, Vermont, Philadelphia, Pennsylvania.

An example of an ecological planning study, identifies a number of carrying capacity: water quality, governmental services, water supplies, erosion, highway congestion, schools, aesthetics. . . . Calculates town carrying capacities based on present state stream quality and dilution standards.

Williams, Edward R. and Peter W. House (1974). The State of the System (SOS) Model: Measuring Growth Limitations Using Ecological Concepts, U. S. Environmental Protection Agency, EPA-600/5-73-013.

A regional resource, economic, and quality of life model developed around the concept of carrying capacity. Section III (pp. 10-26) provides an overview of ecological concepts, relating them to carrying capacity, resilience, and stability.

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